

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of

Johannes BOS

Group Art Unit: 1796

Application No.: 10/580,018

Examiner: G. LISTVOYB

Filed: May 19, 2006

Docket No.: 127898

For: PROCESS FOR MAKING DAPBI-CONTAINING ARAMID CRUMBS

REPLY BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The following remarks are directed to the new points of argument raised in the Examiner's Answer dated September 10, 2010.

I. The Examiner's Contention That The Relationship Among The Materials Used To Form A DAPBI-PPTA Aramid Crumb Is A Matter Of Routine Experimentation Remains Factually Incorrect And Contrary To The Evidence Of Record

A. The Examiner Has Provided No Support For His Allegation That Crumb Formation Is Strictly Dictated By The Solubility Of The Polymer

In the Examiner's Answer, the Examiner alleged on page 11 that "crumb formation strictly dictates by solubility [sic] of the polymer in a system." However, Appellant respectfully submits that the Examiner's statement is not supported, or described, by any of the cited references (i.e., Vollbracht, Chernykh, Jung and Encyclopedia).

As discussed in the Appeal Brief, DAPBI-PPTA crumb formation from a PPD, DAPBI, TDC and CaCl₂/NMP system is not exclusively, or even predominately, the result of the solubility of the DAPBI-PPTA polymer formed from that system. Rather, a crumb is formed as a result of the specific materials used and the amounts of these materials, regardless of solubility. The Examiner assumes that if one merely adjusts the solvent/non-solvent ratios, a DAPBI-PPTA aramid crumb will precipitate out of solution. This is incorrect because decreasing the solubility of a polymer in a solution results usually (but not in the case of para-aramid) into two phases of which the polymer rich phase might be in the form of floating flakes or powder, and no reasonable expectation that a DAPBI-PPTA aramid crumb will be derived. See Facts 9, 10, 37, 40-42 and 47 of the Appeal Brief.

Because the Examiner's reasoning is not supported by the cited references, the Examiner's allegations would appear to be based on "common sense" reasoning. However, such is not sufficient to establish *prima facie* obviousness because (1) the Examiner has put forth no facts to support this "common sense" reasoning and (2) Vollbracht, Chernykh, Jung and Encyclopedia do not suggest why one would have used the conditions recited in the present claims to have obtained a crumb.

As discussed in the Appeal Brief, a proper obviousness rationale requires at least a suggestion of "all claimed elements" in the cited references. Specifically, in view of (1) MPEP §2142.02 requiring "all words of a claim to be considered", (2) MPEP §2141.02 requiring consideration of the "[claimed] invention and prior art as a whole", and (3) the Board of Patent Appeal and Interferences' recent confirmation that a proper, post-KSR obviousness determination still requires the Office make "a searching comparison of the claimed invention – including all its limitations – with the teaching of the prior art", an obviousness rejection requires at least a suggestion of all of the claim elements. See also *In re Wada and Murphy*, Appeal 2007-3733, citing *In re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir.

1995) and *CFMT v. Yieldup Intern. Corp.*, 349 F.3d 1333, 1342 (Fed. Cir. 2003).

Because the cited references do not describe any suggestion of achieving a DAPBI-PPTA aramid crumb from a PPD, DAPBI, TDC and CaCl₂/NMP system, or a method of forming a DAPBI-PPTA aramid crumb from the recited materials, the cited references cannot be found to have rendered obvious a DAPBI-PPTA aramid crumb or method of making the same.

B. The Examiner's Allegation Of Routine Experimentation Is Incorrect Because The Claimed Parameters Are Not Result-Effective Variables

In the Examiner's Answer, the Examiner alleged on page 11 that "relations between monomer content, CaCl₂ [sic] and other technological parameters in order to obtain a crumb can be adjusted by an artisan with routine experimentation." Furthermore, in the Examiner's Answer on page 11, the Examiner stated that a phase diagram could be constructed by varying the parameters, such as the polymer (DAPBI-PPTA)¹, solvent (NMP) and additive or salt (calcium chloride). In other words, the Examiner has alleged that the concentration of the polymer, solvent and salt are result-effective variables in the formation of a DAPBI-PPTA crumb.

The mere allegation of optimizing clearly is not sufficient to establish that Vollbracht, Chernykh and Jung would have provided one of ordinary skill in the art with any reason or rationale to have derived the DAPBI-PPTA aramid crumb recited in claim 2, or the method of manufacturing the DAPBI-PPTA aramid crumb recited in claims 1 and 10, from the specific materials and conditions recited in these claims.

In order to establish that optimization through routine experimentation would have been obvious, the Patent Office must establish that the relevant variables are known, or

¹ The Examiner's Answer incorrectly identifies the polymer as "DFARBI-PPTA". The correct nomenclature for the polymer of the present claims is "DAPBI-PPTA."

indicated, to be result effective, so that one of ordinary skill in the art would have had reason or rationale to have attempted to optimize the values with a reasonable expectation of achieving the indicated result. Specifically, MPEP §2144.05 II B states that before optimization of a particular variable can be found obvious, the variable to be optimized must be described as achieving a particular result.

As discussed above, the cited references (Vollbracht, Chernykh, Jung and Encyclopedia) do not describe any indication of a DAPBI-PPTA aramid crumb from a PPD, DAPBI, TDC and CaCl₂/NMP system, or a method of forming a DAPBI-PPTA aramid crumb from the recited materials. The Examiner's routine experimentation allegation is flawed because the cited art fails to indicate that the parameters may be adjusted to achieve any particular result. Therefore, optimization of the parameters through the alleged routine experimentation would not have been obvious from Vollbracht, Chernykh, Jung or Encyclopedia.

**C. The Examiner's Allegation That A Phase Diagram
Can Be Constructed By Varying The Parameters, Such As
The Polymer, The Solvent And The Additive Or Salt, Is Incorrect**

In the Examiner's Answer, the Examiner alleged on page 11 that at a given structure and molecular weight, the polymer solubility depends on the concentration of the polymer (DAPBI-PPTA), solvent (NMP) and additive or salt (calcium chloride), and that one can simply vary these parameters to develop a phase diagram.

However, the Examiner's "phase diagram" allegation is technically incorrect. In general, a phase diagram can be determined if (1) monomers are polymerized in a solvent or a combination of solvents and (2) the reaction mixture can be separated into at least two different phases, such as a solid phase and a liquid phase. The liquid phase then contains a fraction of the polymer and a fraction of the solvent, both of which are used to form the phase diagram.

In the present case, however, the polymerized product is an aramid (i.e., a DAPBI-PPTA aramid) that forms with the solvent only one single liquid phase or one single solid phase. Further, the polymerized product cannot be separated into a solid phase and a liquid phase (or into any other phase), and thus a phase separation does not occur when the monomers are polymerized to aramids in a solvent, and consequently, the fractions of the polymer and solvent in that single phase must always be 100%. In such a case where there are no fractions of the polymer and solvent in two different phases (such as in the liquid and solid phase) it is impossible to construct a phase diagram. This is the case for the polymerization reaction of all para-aramids.

Specifically, when DAPBI-PPTA aramids are prepared, the aromatic diamine(s) are dissolved in a solvent mixture of NMP and CaCl_2 and strongly stirred. To this solution, TDC (the aromatic diacyloyl chloride) is added under continuous stirring. See page 3, lines 22-30 of the present specification.

However, as confirmed by the Fifth and Seventh Set of Experiments in the Declaration, if the amount of CaCl_2 used is less than the amount recited in the present claims, (1) the mixture remains a homogeneous solution (as occurs in Chernykh) or (2) the reaction mass turns into a homogeneous powder-like mass. The homogeneous solution is solely in the liquid phase and the homogeneous powder-like mass is solely in the solid phase, and thus no phase separation occurs in either of these materials. The fraction of the polymer in these single phases is thus 100% by definition, and no second phase exists. Hence, no phase diagram can be construed.

Furthermore, if the amount of CaCl_2 used is greater than the amount recited in the present claims, the mixture turns into a dough/paste-like material, which also cannot be separated into a solid phase and a liquid phase. See Declaration, Comparative Experiments I-III in Table 8 of the Seventh Set of Experiments. In other words, there is only obtained a

homogeneous single phase (i.e., wherein the fraction of the polymer is 100% by definition), and none of these reactions products contain both a solid phase and a liquid phase that are necessary to form a phase diagram.

Further, if the amount of CaCl₂ (and the other starting materials) is within the presently claimed range, the whole polymer mixture (solution) first forms a dough (as above), which converts into a crumb. See Declaration, Sixth Set of Experiments. The crumb, similar to the powder-like material and dough/paste-like material, is a homogeneous single phase and thus cannot be separated into a solid phase and a liquid phase.

In summation, none of the possibilities described above regarding the preparation of DAPBI polymers (i.e., (1) insufficient amount of CaCl₂, (2) correct amount CaCl₂ and (3) excess amount of CaCl₂) are capable to render a reaction product that can be the subject of phase separation, and thus no phase diagram can be obtained by varying the parameters put forth by the Examiner. For this additional reason, the Examiner's obviousness allegation rests on incorrect assumptions and remains incorrect.

D. The Fifth Set Of Experiments In Mr. Bos' Rule 132 Declaration Further Demonstrates That The Examiner's Routine Experimentation Allegation Is Incorrect

As discussed above, the Examiner alleges that a phase diagram that shows how to achieve a crumb could be constructed merely by varying the parameters, such as the polymer, solvent and additive or salt. The Examiner's "phase diagram" analysis is not only not supported by the art as discussed above, it is incorrect as established by the evidence presented in Mr. Bos' Rule 132 Declaration ("Declaration").

In the Fifth Set of Experiments in the Declaration, Mr. Bos presented evidence regarding eight different types of aramids prepared from PPD, DAPBI and TDC monomers using various salt (LiCl and CaCl₂) and solvent (NMP, DMAc and hexamethylenephosphoramide ("HMP")). The polymer of Experiment 1 (prepared from

DAPBI, PPD and TDC monomers in an NMP/CaCl₂ solvent salt combination) and the polymer of Experiment 2 (prepared from the same monomers as Experiment 1, but in an NMP/LiCl solvent salt combination) both formed solutions, not crumbs. See Appeal Brief, page 71. In other words, Experiment 1 and Experiment 2 of the Fifth Set of Experiments in the Declaration demonstrate that DAPBI-PPTA aramid crumbs that simply vary the type of salt, or the concentration of the salt, do not necessarily form a DAPBI-PPTA crumb.

The Fifth Set of Experiments in the Declaration thus at least demonstrates that the Examiner's allegation of routine experimentation is incorrect because those having ordinary skill in the art would not have succeeded in forming DAPBI-PPTA aramid crumbs looking at a phase diagram and simply manipulating the type of salt to form the polymer.

II. Jung Would Have Directed One In Desiring To Form A Crumb To Have Omitted A Solubility-Promoting Additive Such As Those Described In Jung

In the Examiner's Answer, the Examiner alleged on page 9 that one having ordinary skill in the art would have found it obvious to have used the DAPBI monomer described in Chernykh and Jung in Vollbracht's polyamide and achieved a crumb. See Appeal Brief, Fact 14. The Examiner further alleged on page 13 of the Examiner's Answer that the "same additives [described in Jung are] used in the Application [sic] examined for the same purpose (i.e., regulate solubility of the polymer)." In other words, the Examiner alleges that the present application employs the same additives in Jung to regulate polymer solubility. However, such an allegation further demonstrates the Examiner's misunderstanding of Appellant's arguments regarding Jung.

As discussed in the Appeal Brief on page 29, Jung requires the addition of a solubility-promoting additive. See Appeal Brief, Fact 28. If one of ordinary skill in the art based his or her efforts to obtain a crumb solely on solubility (as the Examiner alleges above), such an individual would not have added a solubility-promoting additive described in Jung

because Jung merely describes the formation of PPTA polymer solutions. The ordinarily skilled practitioner would have further omitted any solubility-promoting additive from the material necessary to form a PPTA aramid crumb, including a metal halide solubility-promoting additive.

III. The Examiner's Allegations Regarding The Evidence In The Declaration Further Demonstrates His Misunderstanding Regarding The Subject Matter Recited In The Declaration

A. The Evidence Presented In The Declaration Is Commensurate In Scope With The Present Claims

In the Examiner's Answer, the Examiner alleged on pages 13-14 that "the experimentations provided are not commensurate with the scope of [sic] the claims 1 and 2" because only two concentrations (10.71 and 8.65 weight percent) were used for the LiCl and CaCl₂ (emphasis added)." The Examiner further states that Chernykh describes a salt concentration of 2.8 to 4.8 weight percent. See Examiner's Answer, page 14 (citing Chernykh, Table 2, page 11).

Before Appellants discuss the Examiner's allegations, Appellant wishes to clarify the Examiner's above statement regarding the "two concentrations" because this sentence (described on pages 13-14 of the Appeal Brief) may be construed as indicating that multiple salt concentrations were used. However, as shown in Table 1 and Table 2 of the Declaration (described in the First and Second Set of Experiments), only a single salt concentration was used (i.e., 10.71 weight percent). The 8.65 weight percent relates to the monomer concentration.

Regardless, this incorrect characterization regarding the evidence in the First and Second Set of Experiments of the Declaration further demonstrates the Examiner's fundamental misunderstanding of the subject matter described therein. First, the evidence presented in Table 1 and Table 2 of the Declaration is related to non-DAPBI containing

PPTA aramids. See Appeal Brief, pages 64-66. As such, this evidence is not intended to be commensurate in scope with the present claims because the polymers described in the First and Second Set of Experiments were prepared without a DAPBI monomer. As described in the Declaration, the evidence in the First and Second Set of Experiments was intended to demonstrate that the formation of a non-DAPBI-PPTA aramid from TDC and PPD using a CaCl_2/NMP solution renders a sufficient inherent viscosity to form an aramid crumb, while LiCl/NMP solution has a significantly lower inherent viscosity and does not form a crumb. See Appeal Brief, page 70.

Furthermore, the Examiner appears to misconstrue the evidence in the First and Second Set of Experiments as relating to criticality or unexpected results. As described in the Appeal Brief, the evidence in the Declaration was presented as evidence of unpredictability associated with forming a DAPBI-PPTA aramid crumb from DAPBI, PPD, TDC monomers using a calcium chloride and NMP solvent/salt combination. Unpredictability merely requires Appellant to demonstrate that a DAPBI-PPTA aramid crumb is formed over the entire claimed range. However, this description is not presented in the First and Second Set of Experiments, but the Sixth Set of the Experiments in the Declaration.

As shown in Table 7 of the Declaration, seven different polymers were prepared by varying (1) the amounts of PPD (referred to as "a" in the present claims) to be from 30-90 mole percent, (2) the amounts of DAPBI (referred to as "b" in the present claims) to be from 10-70 mole percent, (3) the amounts of calcium chloride (referred to as "c" in the present claims) to be from 2.82-11.55 weight percent and (4) the product of "b" and "c" (i.e., "b.c") to be from 104-207.

Such evidence is thus clearly commensurate in scope with the present claims, which recite that (1) the ratio of a : b ranges from 1 : 20 to 20 : 1, (2) a + b is 100 mole%, (3) c is within the range from 1 to 20, and (4) the product b.c is at least 50 and less than 215.

**B. The Final Products In The Third Set Of
Experiments Of The Declaration Did Not Form A Crumb**

In the Examiner's Answer, the Examiner alleged on page 14 that the Rule 132 Declaration contradicts Mr. Bos' statement in the Declaration states that no polymer of high inherent viscosity can be formed when LiCl is used. The Examiner further supports this allegation by pointing out that Table 3 of the Rule 132 Declaration indicates that (1) the inherent viscosity (referred to the Examiner's Answer as "intrinsic viscosity") for a polymer prepared using a calcium chloride salt was from 0.43-0.63 dl/g and the inherent viscosity for a polymer prepared with a lithium chloride salt was 0.41-0.57 dl/g.

Ignoring the inherent ambiguity and lack of clarity in the Examiner's statement (and throughout the Examiner's Answer), the Examiner's mischaracterizes the evidence presented in Table 3 of the Rule 132 Declaration. For the reasons discussed below, Mr. Bos' statement in the Rule 132 Declaration that a polymer with a high inherent viscosity cannot be formed when LiCl is used remains correct.

As discussed on page 68 of the Appeal Brief, the polymers described in Third Set of Experiments were non-DAPBI containing PPTA aramids because the polymers were prepared from a combination of PPD and TDC monomers (i.e., the polymers therein did not contain DAPBI). As such, the polymers described in the Third Set of Experiments are not commensurate with the scope of the present claims, and were not presented as such in the Appeal Brief.

Furthermore, each of these experiments possessed an inherent viscosity of less than 0.63 dl/g. Because the polymers described in the Third Set of Experiments possessed such a low inherent viscosity, Mr. Bos characterized these polymers (formed from calcium chloride and lithium chloride) as "turbid yellow to a brown syrupy mass", and each was thus unable to form a crumb.

As such, the above evidence demonstrates that the Mr. Bos' statement that no polymer of a high inherent viscosity can be formed when LiCl is used is correct and supported by the evidence in the Third Set of Experiments because none of the polymers in the Third Set of Experiments formed a crumb directly during copolymerization.

IV. Conclusion

For all the reasons stated in the Brief on Appeal, as well as the additional reasons set forth above, Appellants respectfully request this honorable Board to reverse the rejections of claims 1-5 and 10.

Respectfully submitted,



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